GAS JOURNAL, FEB. 20, 1946

VOL. 247 98th YEAR No. 4318

UNIVERSITY EDUCATION FOR BUSINESS

THE importance of attracting the best brains into industry has become fairly generally recognized. The Gas Industry has travelled along the same path as many other industries by the appointment of a Careers Committee by the Institution of Gas Engineers. Industry—and this applies equally to the Gas Industry—requires men of many different qualities and professions. The type that springs most readily to the mind in our own Industry is the engineer. It has been customary in the past to consider the engineer as the principal officer in any undertaking and to make him the manager of the undertaking. Certain of the largest companies have not followed this practice of late years, but many great companies and municipal corporations continue to do so. In a small concern it is almost inevitable that the one man should be expected to combine the offices of manager, engineer, and secretary. We are not at all sure that this has not been the cause of many of the unsatisfactory features of our Industry. It may well have been a case of penny wise and pound foolish. Because a man is a good engineer there is no reason for supposing that he must necessarily be a good manager or that he must possess the qualifications of a secretary. It may be economical in salaries to regard the one man as the general factotum capable of doing every job required in an undertaking, including management, technical operation of the plant, distribution engineer, sales manager, advertising specialist, and so forth. It is not, however, the way to get the jobs done properly, and we cannot believe that even quite small undertakings make so little profit that they could not afford both a commercial manager and a technical manager.

Under the modern set-up of industry the functions of management, commerce, and engineering—to say nothing of science—must be in the hands of specialists. The administrator (the manager) requires a particular type of mind for which only a few are fitted by nature, and most must be made fit by training. There is some justification for the belief that training in such subjects as history, economics, law, or modern languages may provide the right background for the administrator. The administrator in turn must have the assistance of a whole commercial staff from the chief accountant, the sales manager, and others at the top grading down to the ledger clerks, bookkeepers, salesmen, and representatives at the lower end of the scale. Equally he must have under him a technical staff consisting of competent engineers and chemists, again grading down to the fitter who, though humble in status, is nevertheless exceedingly important in the conduct of the business of gas supply. With the new set-up of the Industry visualized by the Heyworth Report this larger type of organization will become even more important and general.

It is for this reason that we call attention to a publication entitled *University Education and Business* lately issued by the Cambridge University Appointments Board—a report by a committee appointed by the Board to consider how far Cambridge University was equipping possible students who intended to enter the business world, and whether employers are using the men trained by the University to the best possible effect. We do not propose to say very much about the training which men receive at the University. The report appears to consider that generally speaking this training is adequate. What is much more important is the use which industry is making of university graduates, and indeed of all active members of the staff who, either by prior training or by continuing their education while still at work, show themselves to be both ambitious and capable.

THE QUESTION OF COMPETENCY

BUSINESS requires, not men who have received a particular education, but men who can perform certain defined tasks.

Nevertheless, with the spread of education and the increasing complexity of business it is likely to become more and more important that business should attract an adequate supply of the ablest minds; clearly a good proportion of these will be drawn from universities, or will have taken a university degree or some high professional qualification either before or after entering the Gas Industry.

It is of no use encouraging men of this type to enter the Industry unless they are given ample facilities for promotion. Unless they are given those facilities in such a way that they themselves understand that they are not among the forgotten men of the Industry. The University Report points out that if business is to attract a larger proportion of the ablest men from the university, it will find itself in competition with other occupations. There is no unemployment problem for really able men from the universities, and they have a wide range of employment from which to choose. With the less able the matter is different, but as certain firms complain that they do not get a choice of the best men, some suggestions are put forward in the report to remedy this.

Probably the strongest incentive determining choice of occupation for the best type of graduate is a desire for responsibility. "Naturally he expects that the remuneration should be such as to enable him to marry at some period in the late twenties, and to provide his children with an education similar to the one he has himself enjoyed. Apart from this general proviso the financial incentive is not very strong, and his choice of occupation will be mainly determined by the interest his work is likely to provi de, its social usefulness and the degree of responsibility it carries."

The Cambridge experience is that poor remuneration is not the principal complaint of graduates in industry, but rather the want of an opportunity; this and lack of responsibility are constantly referred to as frustrating the usefulness in business of men of high calibre such as university men. This is so marked a feature of the report that the Cambridge Committee declares roundly that able graduates should not be recruited by firms unless there are obvious positions of some responsibility to which they may reasonably look forward in the not too distant future. Naturally no promises can be made, because much will depend on how the graduate develops when he enters business, but it should be clear both to the graduates and the firm that such positions are available provided the graduate becomes capable of filling them. Some graduates complain that firms, when recruiting university men, hold out prospects of positions of responsibility, and that after a time it becomes clear that there is little likelihood of these prospects materializing. Such a practice must destroy the university man's confidence and have the effect of making the best men enter other employment, so that business will only be able to recruit from the less able graduates. This is a result to be avoided.

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HOW then should the Gas Industry treat men of high calibre such as those having university degrees or other high qualifications when they enter it? There can be little doubt that the training provided for these men, or the lack of it, is one of the most important factors affecting their ultimate usefulness. The "sink or swim" method of training is strongly condemned. It must be recognized that however well qualified

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a manmay be from an academic point of view or from the point of view of one of the professions, as a young man he will not know very much about business, and he must be trained in a carefully organized manner. The University Report states that the graduate will be most effectively trained in business methods if his training is a natural sequence to his university education. This has taught him to try to appreciate the general principles involved in a subject, and to co-ordinate the necessary facts by reference to underlying theory. A multitude of instructions will be meaningless to him unless he first understands the principle of their interaction. When he understands this the facts will be fitted into a co-ordinated whole. They will become part of his mental habit, not because he has memorized them, but because they are the essential symbols of his thought. The focus of attention on principle will lead to the emergence of new facts relevant to a situation. It is the capacity to discover new facts and relate them to general principles that gives birth to new ideas, which is said by many firms to be one of the main assets of the best type of university man in business.

It is desirable that a graduate entering business should go through each department of his new firm so that he may understand the whole of its framework and the relationship between departments. It is not, however, necessary that he should be left in each department for the time necessary to acquire full proficiency. Modern industry is so highly subdivided that no one can be expected properly to learn the multitude of special skills involved. What is necessary for those being trained for management is that they should know something of the special skills in each department and their relative difficulty, and that they should know a great deal about the interaction of departments. The latter can best be learned, not in a particular department, but from the managerial staff, after a working knowledge of each department has been acquired. It is here that most of the graduate's training period could best be spent. It has been found during the war that it was best not to keep those who were likely to make good officers too long in the ranks, though it was definitely advisable that they should first go through them. If, however, they were kept there too long, it had the effect of diminishing their spontaneity and initiative, the very qualities most desirable in an officer. The same may easily take place in training graduates for managerial posts. Some in fact complain that they have been kept so long in subsidiary positions that when responsibility has at last been given them their minds are too deadened to make the best use of it.

THE LOYALTY FACTOR

MANY of the most thorough training schemes lay proper emphasis on the desirability of bringing the young graduate into close contact with the managerial staff during his period of training. If, after a preliminary period of training, he is made the personal assistant of a member of the managerial staff, it will give him a clearer insight into the policy of the firm and its methods of management. Such personal assistance should be essentially active, and the trainee be required to carry out tasks so that his methods and results can be clearly seen by the member of the staff to whom he is attached. This kind of training will afford the staff full opportunity of judging his ability, and ultimately deciding where it can best be used. The appropriate senior member of the staff should make it his business to keep in constant contact with the trainee to give him advice and assistance. The young man entering business must appreciate the purpose and method of his training, and he must get a fair deal at the hands of the executive under whom he is working. A great value of training is to arouse a feeling of loyalty towards the undertaking, and this feeling can only arise in an atmosphere of adequate personal relationships between trainee and those responsible for the direction of policy.

It is important that the graduate should be fully stretched throughout his business training. Although some young graduates are apt to be impatient and think that they can take charge of activities of which they have not yet sufficient understanding, yet it must be remembered that these men come straight from the university with habits of absorbing knowledge and instruction and taking a good measure of responsibility for their age. Nothing so quickly breeds a sense of frustration as a feeling of time being wasted in the attainment of a responsible position. Prompt steps should be taken to appoint the graduate, when fully trained, to some minor executive post of responsibility, in regard to which he will of course come into direct competition with schoolboy or other entrants. The utmost effort should always be made to secure the retention of every graduate recruited by the firm as a contented member of its staff. In the interest of the successful recruitment of graduates by business generally this is extremely important.

In this discussion we have not specifically touched upon the technical side of the Industry. We have in mind the principle that any young man who comes into industry with a university degree, or who studies either for the university degree or the membership of a senior professional body, whether commercial or technical or scientific in its general outlook, is a person whom the Gas Industry should encourage. A great deal of lip service is paid to the encouragement of the young man in the Gas Industry, but in many quarters it is no more than lip service. There are outstanding examples of the right attitude, but there are also many instances of the wrong attitude. What we have in mind is that our Industry should take in hand this problem of training and adequately rewarding the keen man in its ranks. Whether it is a matter for the British Gas Council or for the Careers Committee of the Institution we do not know. It concerns all branches of the Industry, and not only the technical and scientific branches. It is a matter which must be taken in hand properly as part of the general reorganization of the Industry—irrespective of nationalization.

Personal

Mr. F. B. KERR has been appointed Engineer and Manager of the Elgin Gas Department; for six months he has been Assistant Manager at Elgin, and was formerly assistant at Johnstone.

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In announcing in our issue of Feb. 6 the appointment of Mr. S. H. STOKES as Engineer and Manager of the Wath, Bolton, and Thurnscoe Gas Board we erroneously gave his initials as "S. G. C."

* * *

Mr. A. E. R. LOGAN, who for the past five years has been an Advertisement Representative on *The Times* and *The Times Trade and Engineering Supplement*, has joined the "JOURNAL" and "GAS SERVICE" in a similar capacity.

* * *

Mr. J. F. WILSON, Technical Assistant to Leicester Gas Department, has been appointed Assistant Engineer and Manager of the Stirling Gas Light Company. He succeeds Mr. J. MCPHERSON, who is now Engineer and Manager at Linlithgow. Mr. Wilson received his training at Perth.

* * *

The Board of E. Boydell & Co., Ltd., has been strengthened by the inclusion of three senior members of the staff. Of these, Mr. A. E. RYELAND and Mr. B. N. JOLLY have been responsible for the sales of Muir-Hill equipment in Southern and Northern England respectively. The third new Director, Mr. F. A. ALLEN, has been Works Manager since the Company's earliest days. Mr. E. BOYDELL, founder and Manager Director, continues as Chairman, and the fifth member, Mr. H. E. EVANS, F.C.A., who was the only other Director until recently, will continue as financial adviser.

Obituary

Mr. T. H. ARMSTRONG, Joint Secretary of the Hawick Gas Company, has died at his home at the age of 84. He is survived by his wife, son, and three daughters.

The London Industrial Groups of the Royal Society for the Prevention of Accidents are arranging a one day Conference on Monday, Feb. 25, at Caxton Hall, London, S.W. 1. Papers to be presented and discussed include : "The Work of the Industrial Health Research Board," by R. S. F. Schilling; "Industrial Safety as an Aspect of Management," by A. P. Young; "Lighting and Vision in Relation to Accidents," by H. C. Weston; "The Human Factor in Accidents," by Eric Farmer; "Heating and Ventilation in Relation to Accidents," by T. Bedford.

Letter to the Editor

Nationalization of the Gas Industry

DEAR SIR,—No doubt all gas undertakings have received the apologia from the British Gas Council seeking to exculpate itself from the inevitable result of its own actions. I regret that I must say that I have rarely read a more specious and misleading document.

The nationalization or non-nationalization of the Gas Industry is a matter that can only be settled on the floor of the House of Commons by consideration of proposals placed before Parliament by the Government. To argue that because the country has returned to power a Government pledged to nationalization (*inter alia*) of the Gas Industry, the Industry must perforce accept nationalization when the same has not even been placed before the House, is not only a cowardly and defeatist attitude, but definitely cuts the ground from under the feet of those Members of Parliament and others who would assist the Industry in seeking to prevent nationalization and who, if they are opposed to it, are in duty bound to do their utmost to circumvent it.

What is the use of saying that the Industry cannot take part in political controversy? Why can't it? Is not the whole issue a political one? Would the same argument be advanced if it had been proposed to expropriate shareholders without any compensation? The question has only to be asked to show that the argument is completely fallacious. The Industry has a duty to take part in political controversy if in so doing it is standing up for the principles in which its leaders say they believe and to which they profess to pay lip service.

I may say at this point that on Nov. 20, 1945, as soon as the Government's nationalization proposals were made known, I sent the following telegram to the Gas Council:

"Hope you will declare implacable opposition to Government nationalization proposals and will invite similar action of all threatened industries and professions. Inspired and courageous leadership vital not only for future of all industry but in defence of personal freedom of every citizen special shareholders' meetings should be called, and consumers circularized £20,000 publicity campaign forthwith."

The Gas Industry has (or had) an unrivalled organization in the B.C.G.A. for putting the public *au fait* to the inescapable implications of nationalization. They are quite clear and obvious—increased costs or else subsidy by the taxpayer. If the Industry is prepared to collaborate with the Government in nationalizing itself out of existence, it is, of course, playing into the Government's hands. What the Government is really afraid of is solid opposition, and if the leaders of the Gas Industry are against nationalization, but are not prepared to do all that they legitimately can to try and prevent it, then they cannot expect to escape from the accusation that they have "sold the pass"—as indeed they have.

Let me now comment on a few completely inconsistent features of the memorandum. Constant reference is made to the Heyworth Report as if that Report was bound to be accepted by Parliament. Has the Council so little political acumen as not to see that the relegation of a thorny problem to a Committee of Investigation is a time-honoured device for shelving the issue, and there is not the slightest reason for supposing that the Report would necessarily have carried any particular weight with a free Party Government opposed in principle to control by the State.

It is true that so-called opponents to nationalization have in the National Government constantly sacrificed principle for expediency during the stress and duress of war. Is that a reason for adopting the same procedure by those who claim to be leaders of an Industry which, on their own showing, requires not additional stimulus but the removal of restrictions. Could not the Council have stated when the Minister said that the "policy of nationalization was not discussable," that they were not prepared under those circumstances to discuss anything at all until they had seen what the proposals of the Government were? Instead of following that logical and commonsense course, the Council seemed determined to assist the Minister to get out of a position of extreme difficulty from which it is probable that he would have been wholly unable to extricate himself.

Paragraphs 12 and 13 are based on utterly false reasoning and are completely inconsistent with each other. To state "the only practical alternative to acceptance is to eject the present Government" is of course the veriest nonsense. The Gas Industry as such has no power or authority to "eject the present Government." What it has power to do is to take all steps to tell the public what nationalization means, to inform the public that the Industry already functions under "statutory" as distinct from State Control, and that the so-called monopoly of the Gas Industry is in point of fact completely dependent upon the observance of its obligations to the public. Not a mention of this has been made in any statement that I have seen. Not a hint has been given of the way the Gas Industry had developed under free enterprise for over 100 years.

In Paragraph 10 the Council appears tremendously pleased that the Minister was appreciative of the fact that he could deal with one body "representative of and loyally supported by the whole of the Gas Industry." Yet in Paragraph 14 it is stated that the Council does not even know what is the attitude of the municipal side of the Gas Industry to the Nationalization proposals. Again, if the Council takes credit for speaking for the whole of the Gas Industry how can it say, as it does in Paragraph 11, that "it does not purport to bind boards or committees on matters of high policy"? It is surely evident that the Council has at last come to understand that in fact it does *not* represent the views of the whole Industry, and is now making a lame attempt to justify an attitude which has met with the strongest criticism, not merely from the Gas Industry *but from other Industries which are similarly threatened*, and which are prepared to fight for their freedom and their liberty.

It may be as well, perhaps, to emphasize that in our so-called Democracy it is still permissible *as yet* for a minority to have rights, and to endeavour to persuade other members of society to accept its viewpoint. That being so the issue cannot be burked. If the Industry is against nationalization, then every constitutional means should be taken to obstruct it. If it is for it, then let it by all means co-operate in its own obsequies. But it cannot have it both ways, and if it tries to do so it must inevitably earn for itself the reputation of running with the hare and hunting with the hounds, and reaping for its reward both contempt and contumely. The freedom of Englishmen has never yet been won by appeasement or surrender, and unless those who aspire to lead are prepared to hold aloft the torch of freedom it is not to be expected that the masses will do anything else than tamely follow those who dangle the bait of a better time for all at somebody else's expense.

Let the British Gas Council call a meeting of the Industry so that the whole matter can be put to the vote. If at such a meeting the majority decide that it accepts the principle and authorizes the Council to endeavour to work for the best terms, then there is nothing further to be done. Those of us who see in the nationalization of the economic life of this country the imposition of a totalitarian regime, which will not only bring about financial disaster and collapse, but the complete destruction of all personal freedom through the subjugation of the rights of the individual, will have done what they can. Those who, professing to be against it, yet assisted its proponents will have to stand before the bar of history as having played an active part in bringing it about.

5, Great Winchester Street,
Old Broad Street, E.C. 2.
Feb. 2, 1946.

Yours faithfully,
HYDE C. BURTON.

Light Metal Development

The collaboration of a group of light metal manufacturers, which found its origin in the days of war with the pooling of technical information in the national interest, has resulted in the formation of a development organization known as Alar. Through this organization the co-operative efforts of the technical staff of each of these manufacturers is now being applied to the peace-time requirements of industry.

The purpose of Alar is firstly to ensure that the present high standard of secondary aluminium alloys is maintained, and secondly, to promote their use by bringing about a wider appreciation of their properties.

During the war, the quality and conformity with specification of the greater part of the aluminium used by founders were guaranteed by an accompanying A.I.D. release note. With the return to peace-time conditions much of the A.I.D. control is disappearing. The advantages enjoyed by the founder under this inspection system are, however, maintained for industrial and commercial applications by means of the control procedure sponsored by Alar. Under this procedure, which is similar to that employed by A.I.D., alloys are manufactured and inspected in accordance with Alar regulations, and an Alar release note is issued to this effect, thus providing the user with an assurance that all the requirements of the appropriate specification have been observed.

Alar is solely a technical organization. Its research programme, which includes the development of new alloys, is carried out in close collaboration with other technical and research associations. An important feature of Alar's policy is the issuing of information on the properties and applications of aluminium alloys.

Diary

Feb. 23.—Manchester and District Junior Gas Association: Morning Visit to Leyland Motor Co.; Afternoon Visit to Leyland Gas-Works. "Some Considerations of Power Utilization on a Medium Sized Gas-Works," S. Ashworth.

Feb. 23.—Yorkshire Junior Gas Association: Discussion opened by J. Bateman and W. T. Bird, Royal Victoria Hotel, Sheffield, 2.30 p.m.

Feb. 26.—Midland Junior Gas Association: Day Visit to W. C. Holmes & Co., Ltd., Huddersfield.

Feb. 26.—Southern Association of Gas Engineers and Managers (Eastern District): "Education in Industry," Dr. P. F. R. Venables, Gas Industry House, 2.30 p.m.

Mar. 2.—Scottish Junior Gas Association (Eastern District): Visit to Castlecary Works of J. G. Stein & Co., Ltd., Bonnybridge.

Mar. 5.—Midland Junior Gas Association: "Gas-works Liquors and their Disposal, with Special Reference to Electrostatic Tar Precipitation," G. J. Rimmer.

Mar. 8.—London and Southern District Junior Gas Association: "Domestic Gas Cookers—The Design of the Hot Plate," E. W. B. Dunning, Gas Industry House, 7 p.m.

Mar. 13.—B.G.C. Domestic Development Committee. 2.30 p.m., Gas Industry House.

Photometric Integrators

A revision of the British Standard Specification 354 for Photometric Integrators has just been issued. The principal changes are in the size of the integrator, which has been extended to provide for tubular fluorescent and other tubular lamps. The formula for the paint for painting the interior of the integrator has also been revised.

The specification for photo-electric type portable photometers (B.S. 667) has also been modified and re-issued, the chief modification being a reduction in the figure for the change in the indication of the colour of the light source from 6% to 5%, and the addition of a note to the clause on oblique illumination pointing out that the more stringent requirement to be satisfied when illuminations of less than 1 ft. candle are in question ensures that the error of the instrument shall not be excessive for street lighting and similar measurements.

Copies of these specifications may be obtained from Publications Department, British Standards Institution, 28, Victoria Street, S.W. 1. Price 2s. each.

The Question of "Know-How"

In a recent speech to the Northern Industrial Group at Newcastle, Sir Edward Appleton, G.B.E., K.C.B., F.R.S., Secretary of the Department of Scientific and Industrial Research, suggested that traditional knowledge amassed and handed down in course of time from one generation to another may, in certain circumstances, be as exact as the knowledge gained by the scientific method. "This," he continued, "is important from our point of view, since such traditional knowledge still forms the basis upon which many of our older industries are conducted. No scientist would say traditional knowledge as such was necessarily wrong. Obviously it is not, for it consists of observations handed down from craftsman to craftsman until a successful 'know-how' has been established. But it is a 'know-how' severely limited in scope because it depends on the process, tools and material remaining unchanged. Speed up the process or omit certain stages, or substitute a new material with qualities which differ from the original material, and the whole edifice of the traditional 'know-how' falls to the ground; the result of trying to apply it in changed circumstances ends in failure and loss.

"There have been many examples of this—for instance, when quick setting plasters were introduced to speed up building operations it was found that the attempts of craftsmen to use these plasters in the traditional manner met with complete failure, and an entirely different technique, based on the properties of the plaster ascertained scientically, had to be evolved. Obviously in an industry wedded to traditional methods new technical knowledge can only be acquired slowly by process of trial and error; thus such an industry must be inflexible in its operation, and it is extremely difficult for it to take advantage of new methods or new materials. It remains stagnant and unprogressive."

Discussing the application of scientific method, Sir Edward Appleton referred to the recently published report on the Heating and Ventilation of Dwellings, compiled as a result of the study of the problem by the Sub-Committee of the Building Research Board of his Department. The Committee, he explained, soon decided that the first thing to find out was what the basic requirements of heating and ventilation in a house really were. Once this was done the technical problems to be solved could be stated. This meant covering an immense amount of ground. "Think," he said, "of the many questions, all involving human likes and dislikes, that had to be answered. How warm should a room be? How much ventilation did people really want and what was the minimum need? How and to what extent was heat lost from the human body in a room? And so on.

"In getting the data many methods were employed. My Department arranged for the Social Survey of the Ministry of Information to undertake a survey of housewives' opinions on heating, cooking, washing, laundering, and ventilation. The Survey did not confine itself to plain answers of 'yes' and 'no' from the 5,000 housewives interviewed. Likes and dislikes, prejudices and preferences, were all carefully tabulated and the results statistically co-ordinated.

"This was one way in which the scientists obtained their facts. At the opposite extreme was the method of determining the heat loss from the human body. There are four factors which affect this—air temperature, air movement, radiation from the surroundings and humidity. The D.S.I.R. and the Medical Research Council devised a scientific instrument which measures three of these factors, but is not able to take account of humidity. Thus the likes and dislikes of the housewife were given concrete expression as the readings of a measuring instrument. From there on the way was clear to the technical study of how the heat could be obtained, how heat losses from buildings could be prevented, what the relative efficiency and cost of various heating appliances were, how the ventilation could be provided, and what amenities should be considered. The result of this work, which took more than three years to complete, called in the best brains from every industry concerned and scientists in and outside Government service. That report is now available for housing authorities, builders, architects, and the people who live in houses to find out what they should do to obtain the greatest comfort at the smallest cost and the smallest expenditure of fuel."

Gas Industry—Present and Future

The Fabian Society has recently issued a pamphlet by Joan Mitchell entitled "The British Gas Industry—Present and Future." It is a companion volume to the Society's earlier publications on electricity and coal and, as Mr. Leslie Hardern points out in his foreword, the time is ripe for some such account to be presented to the public. Commencing with a brief history of the Industry and its development, Miss Mitchell outlines the problems with which it is now faced. Various methods for reducing the price of gas are discussed. Manufacturing costs may be reduced by improved equipment, more extensive research and advertising, and by increased benzole extraction and coke grading. A saving in distribution costs is possible by increasing bulk supplies to industrial customers, and by increasing general sales to compensate for the decrease in individual consumption. The pamphlet deplores the varying prices charged by different undertakings. Discussing holding companies and amalgamations the Author remarks, "whether consumers or the Industry would benefit would depend entirely on the influences inspiring such tendencies."

The pamphlet was written before the issue of the Heyworth Report, and advocates the formation of a Central Gas Board to undertake research and to represent the Industry in Government affairs. Miss Mitchell suggests seven regional boards as against the Heyworth Committee's ten, the purpose of which would be to decentralize the Industry and to enable each region to be treated as an economic unit. The pamphlet is No. 103 in the Research Series of Fabian Publications, Ltd., and the price is 1s.

Gas Light Fleet's War Record

The February issue of the Gas Light and Coke Company's Co-Partners' Magazine gives an account of the fine services rendered by the Company's ships during the hazards of war. Of the ten ships lost, nine suffered through enemy action and casualties were unfortunately heavy.

Eleven members of the crew of S.S. "Gasfire" lost their lives when the vessel was struck by a torpedo. The ship, her stern carried away and her main engines destroyed, was towed to port and repaired, but was hopelessly damaged and sunk only two months later. Torpedoes were also responsible for the sinking of S.S. "Horseferry" and the deaths of eleven of her crew, and for considerable damage to S.S. "Firelight." Both S.S. "Gaslight" and S.S. "Flashlight" received two bombs alongside, and the latter had to be abandoned. During an attack upon their convoy one of the crew of S.S. "Fireside" lost his life by diving overboard in a gallant attempt to save the lives of men of another ship which had been hit. The S.S. "Icemaid" was the victim of a mine, but, despite the serious damage incurred, she was towed safely to port. The collier S.S. "Mr. Therm" was mined in 1941 and lay nearly submerged for five months. After raising and re-fitting she served for two years before being requisitioned by the Government. In company with S.S. "Halo" she took part in operations around D-day, but was eventually lost in January last year.

The article includes an exciting account of rescue operations performed by the crew of S.S. "Olga," and lists the awards granted to personnel of the Company's ships. Of the 11,400,000 tons of seaborne coal used by the Company during the war years, over half was carried by their own fleet—a fine record indeed.

"Britain Can Make It"

Each of the fuel industries has appointed an Executive Committee to act in liaison with the Council of Industrial Design on the occasion of the National Exhibition of Design which opens at the Victoria and Albert Museum on September 24.

In addition to individual displays, about 20 rooms—kitchens, bathrooms, dining rooms, bedrooms, nurseries, living rooms—are to be planned by individual designers in consultation with the Council. In the kitchens will be cookers and water heaters, washing machines, pots and pans, and specimens of the new labour-saving domestic machinery which is being developed at the present time. All the furnishings and equipment will be laid out as though for use. The decoration and furnishing of living rooms and bedrooms, the fittings and equipment of bathrooms and nurseries, will demonstrate that British manufacturers and designers have turned their skill from war to peace and are making great strides forward. There will also be a considerable number of "annexes" or corners of rooms for alternative exhibits.

The name of the manufacturer and, where possible, the designer of each article exhibited will be published, except in cases where the circumstances are such that straight-forward competition among different firms for the verdict of the Selection Committee has not been possible, or in cases where, for reasons connected with the war, any large part of an industry is not free to submit goods. The names of manufacturers and designers will not be placed on the actual goods, but will be displayed and/or published in other ways which are under consideration.

There will be a number of information bureaux placed throughout the Exhibition to deal with enquiries from buyers or the public. In particular, these bureaux will be able to give enquirers the names of manufacturers and designers in those exceptional instances where these cannot be displayed or published.

Gas Utilization—Future Prospects and Needs in the Domestic Sphere*

By Dr. HAROLD HARTLEY

(Vice-President of the Institution of Gas Engineers)

ONE of the principal functions of the Gas Industry is to provide heat services for the community for cooking, space heating and water heating. Before the war the domestic load accounted for approximately two-thirds of the gas sales of the Industry, and the cooking load for some two-thirds of the total domestic load. Although in the years to come the demand for gas for cooking in existing middle-class homes may shrink owing to a variety of causes, there is reason to anticipate in the near future an additional cooking load owing to the building of new houses. In addition there will be a demand for gas for the provision of the other two services which will be needed by many domestic consumers. On the whole there should result a great increase in the use of gas in the homes of the people. According to the Heyworth Report (para. 111), 67% of all gas consumers are prepayment consumers, and about 65% of all domestic sales are made through the slot meter. Although the proportion of domestic prepayment consumers will be more than 67%, these figures do suggest that the amount of gas used by the quarterly consumer should be increased considerably. There will be less sales resistance to overcome in persuading such middle-class consumers of the advantages of gaseous fuel for space heating and water heating.

To-day the sale of gas to domestic consumers is much influenced by the general level of prosperity in the country, and this is readily understandable in view of the large part played by the prepayment consumer. The quarterly consumer, however, is less affected by such changes, and among the last things he will do is to reduce his standard of living and general comfort—certainly in so far as his home life is concerned. Many in that section of the community were accustomed, in the past, to employ domestic staffs to carry out the more tedious and unpleasant household duties. During the war, however, many of them have been compelled to do these chores themselves, and as this state of affairs may continue they will be only too willing, as soon as conditions permit, to adopt systems of heating which will eliminate such undesirable work.

For continued use it is, of course, cheapest to employ coke for both space heating and water heating, but a middle-class consumer is not going to worry about expending a few shillings a week to do away with the need for laying solid fuel fires and removing the ash, and this section of the community needs cultivating more than in the past.

Improvements in Cooking

In the cooking field thermostatic control, introduced to this country about 23 years ago, has proved a boon, not only to the public but to the Industry. The use of the thermostatically-controlled gas oven, supported by the explanatory work done by the sales and demonstrating staffs of the Industry, has been largely responsible for the very marked improvement in the quality of cooking which has taken place in middle-class households.

From the technical point of view, appreciating the limitations imposed by conditions of usage, the advances made in the last quarter century are reasonably satisfactory. Nevertheless, in so far as they are applicable, the criticisms in the Heyworth Report cannot be ignored. In paragraph 220 it is stated, "The present methods for utilizing the kinetic energy in the hot products of combustion leave much to be desired," and again in paragraph 221, "The domestic cooker, which is an appliance of first importance to the Industry, still calls for technical improvement. The criterion, so far as the consumer is concerned, is operational efficiency as distinct from thermal efficiency; in this respect the design of the hotplate and of the cooking utensils leaves much to be desired."

The authors of the Report seem to envisage designs which, while convenient for the householder to use, may in themselves be more complicated. It is not difficult to produce a piece of apparatus highly efficient for the transfer of energy from a flame to water, and over thirty years ago instantaneous water heaters with an efficiency of 97% gross C.V. were manufactured. It is understandable that a report that the efficiency of a boiling burner on a hotplate may be as low as 40% seems very unsatisfactory, if the limitations imposed by the conditions of use are not appreciated.

In view of the suggestion that the design of cooking utensils leaves much to be desired, it may be desirable in the future to give more thought to the production of special utensils for gas consumers.

Gas appliance designers must not be compelled to work on restricted lines; development in the future may involve the use of electrical and/or mechanical equipment with the object of improving performance to an extent not yet envisaged. When battery ignition was proposed for gas fires some years ago, the development was stifled at the outset by the attitude of some gas officials and, as a result, "flint" ignition is still used. At the same time there must be appreciation of what the user will "stand" in the way of mechanical additions, and how much can be afforded for convenience in the way of prime cost. Although the fuel cost per meal is about 1d., a cooking service is being provided.

Technically Informed Service

The needs of the post-war houses have emphasized the importance of having technically informed people to deal with utilization matters. It is not sufficient to know the size of cooker required for a given family. There must be full appreciation of the importance of correct installation, of the influence of such factors as the ventilation of the kitchen, and the effect on the user of overheating during work. There is need of a better understanding, not only of the functions of the parts of the cooker, but also of a greater appreciation of what is required in the preparation of food. There must be a realization of the wasteful manner in which appliances may be used, and the bad effect that such waste, even if incurred by the user, will have upon the prestige of the Industry. When high-powered high-speed burners are supplied, the wastage following careless usage is correspondingly high, and the price the consumer pays for the convenience of extra speed may become excessive, especially for the lowest income group. Such a feature, which at first sight makes a good talking point for salesmen, may, in the long run, have a bad effect on the gas consumer's reactions. It is not wise to consider only the short term effect of a proposal.

As means are found of increasing the efficiency of the transfer of energy from the burner flame to the utensils on the hotplate, the rating of the burners should be reduced and not maintained at the present figure, or even increased, as some would suggest.

Design has now passed the stage when the sole considerations were that the gas used should be kept to the minimum, and there should be no danger of smothering of oven burners. The changes which take place during the cooking of foodstuffs, the effect of changes in the atmosphere within the oven on the resulting product, the influence of the temperature at which the process is carried out, and the operational time are all investigated to acquire fuller knowledge of what is needed to ensure the best result.

Some will have noticed the reddish material which is formed on the surface of meat roasted in the gas oven. This results from an effect of products of combustion. The red substance is nitroxy-haemoglobin, the material responsible for the red colour of corned beef, and is produced by the minute traces of oxides of nitrogen formed in the gas flame reacting with the haemoglobin in the meat. Miss C. N. Edgecombe has investigated this matter, as well as the influence of the other constituents of products of combustion on the cooking process. The work was completed some years ago, but it is hoped it will be possible to publish the results in detail later in the year.

It has been suggested that gas ovens tend to become dirtier during meat roasting than electrical ovens. If there is any justification for such a statement, it arises from the temperature conditions during the cooking operation. By attention to this factor, splashing of fat can be eliminated, and improvement in cooking effected, which is especially noticeable when the joint is eaten cold.

Trend of the Cooking Load

The Heyworth Committee, drawing attention to the effect which the improvement in gas cooker performance has had already on gas usage, expresses the view that the cooking load must shrink further. It will be agreed that ultimately this must happen. The changing habits of the people, and especially the increase in gregariousness and the desire for more relaxation and entertainment, results in more meals being taken away from the home. In addition, the last 25 years have brought great changes in culinary habits. In few homes to-day is the bread supply baked; many buy confectionery rather than provide home-made articles, and the use of canned foods is increasing. Further, there are still in use a large number of old appliances—the Heyworth Committee suggest (para. 113) probably at least one-third of the whole—and their replacement by a good post-war cooker will probably reduce the load by 40%. The domestic consumer employing gas for cooking in a good pre-war appliance uses some 90/100 therms per year. When the new post-war cookers are available this consumption may fall to 70/80 therms per year. On the other hand, the more economical it is to use the gas cooker, the wider is the range of families who can afford to employ it, and the saturation point has not yet been reached among the lowest income groups in many parts of the country.

* Paper presented to Scottish Junior Gas Associations' Joint Meeting, Glasgow, Feb. 9.

In general, the modern gas cooker stands in high repute with the housewife, such criticism as is offered applying to the trouble experienced in cleaning after use. The gas undertaking finds maintenance is not excessive, but naturally will welcome improvement. Both desire further economy in use if attainable.

The new cookers to be made available this year will have hotplates simpler to clean and more economical to use, which will show an all-round performance better from both the technical and practical point of view. The standards of performance required by the designers of gas ovens to-day are well above those imagined by many housewives, whose expectations in relation to the quality of the cooked food grow, however, with experience of the most modern cookers. Nevertheless, the post-war oven will show improvement on the latest pre-war types in the quality of the cooking, and considerable economy in gas usage. The problems of the undertakings in supplying and maintaining cookers have also been considered, and the designs to be made available will give satisfaction in this respect. Altogether, the claims which it will be possible to make for the post-war gas cooker are such that the Industry need have no fear from the technical point of view of any competition it is likely to meet. It is felt that the post-war product will enable the pre-eminence of the gas-operated appliance to be maintained, and will ensure its even wider usage.

Water Heating

Both the water-heating and space-heating fields offer great possibilities for expansion of the domestic demand for towns gas, but it seems that the water-heating load may be potentially the greater in value—at least in the immediate future.

Of recent years, and especially in the south, there has been a rapidly growing demand for coke for the supply of hot water. Some of the load which can be obtained for gas will be at the expense of coke. Gas is a more costly fuel, but should make appeal particularly to the middle-class consumer provided the equipment used gives a service at least as good as that obtained from the solid fuel system.

Even in connexion with the post-war houses in which the government and local authorities are interested, much consideration has been given to the provision of a summer hot water service for which either gas-operated or electrically-operated appliances have been recommended. There is general recognition of the desirability of providing auxiliary equipment, and the direct competition between gas and electricity will be keen. The electrician will stress the simplicity of installing immersion heaters in the hot water cylinders which are to be provided in these new homes, and the gas man will emphasize the economy of gaseous fuel and the greater elasticity offered by the gas appliance.

The cost of providing the service for any given system will depend on the prime cost of the energy and on the efficiency in use of the auxiliary appliance, whether it be gas or electrically operated. In both cases the cost is much influenced by the dimensions of the installation and by the conditions of use. Both gas and electrically heated equipment have a high transfer efficiency for the heating of the water itself, but the effective efficiency in terms of useful hot water obtained for the energy expended is appreciably lower. With a well-insulated system, and a gas circulator yielding a transfer efficiency of 75%, an overall efficiency of between 50% and 55% is attainable, depending upon the design of the storage system and the service required from it. In other words, the effective efficiency may be roughly two-thirds of the transfer efficiency, and in many cases this is a suitable relationship to use in computing the cost of the household service. It is not desirable to use a circulator unduly powerful for the work if cost of operation is a consideration, although a more powerful circulator provides a more flexible system and a better service.

One of the great advantages of the coke hot water system is that the maintenance cost is low, except in the hard water districts, where special problems arise. In the past the gas-operated appliance has needed more maintenance than its coke equivalent, owing to the corrosive effect of the products of combustion on the material used in the manufacture of the heater. Some undertakings have even found that the cost of maintenance of water-heating appliances—and this really applies to instantaneous heaters—has been so high as to render the water-heating load barely an economic one. The extent to which corrosion of the combustion chamber of the heater may occur is largely influenced by the amount of sulphur in the gas, and the extent to which condensation takes place. The more modern so-called non-condensing heaters corrode much more rapidly than do the older types in which liquid condensate collects in the base. Gas undertakings have been urged to reduce the sulphur content, and in 1942 the Institution of Gas Engineers appointed an *ad hoc* committee under the chairmanship of Dr. H. Hollings to report on this matter. You will be aware of their recommendations, namely, that after the cessation of hostilities gas undertakings should take steps to reduce the sulphur content of the gas to a maximum of 10 grains per 100 cu.ft., but that subsequently consideration should be given to the possibility of reducing the sulphur content to 3 grains. The Heyworth Committee recommend that the 10-grain maximum be made obligatory, but make no comment on the desirability of reducing the sulphur to 3 grains. Unless this is done there will still be considerable corrosion of many existing water-heating appliances.

In the water-heating field the most needed development is the manufacture of heaters resistant to the action of combustion products and cheap to maintain. An alloy has been found which is little attacked by the products of combustion in such appliances, even with gases containing a high amount of sulphur. The material has also the other physical properties necessary to allow of its use for the combustion chambers in copper heaters. A number of appliances incorporating the material have been on district trial with sulphur-rich gases for some years now, and it has been found that they require practically no maintenance of the combustion chamber—at most probably one maintenance visit every three years.

Although with such circulators it is anticipated maintenance problems will be largely eliminated in soft water areas, in the hard water districts the formation of scale in heaters and flow pipes introduces other maintenance problems. Certain compounds are available, however, which, if dissolved in hard water to the extent of only a few parts per million, produce striking effects in minimizing the formation of hard water scale.

Two types of scale reducer have been evolved; the one incorporates a venturi principle, and the other is of the direct through-flow type. The former is for use primarily with instantaneous heaters, the latter for circulating systems which include a storage tank. The active material is introduced within a gauze cartridge, the whole being made of such a size that replacement once a year of the cartridge is all that is necessary. District tests have been carried out in many different parts of the country with widely different types of water. Provided the water temperature does not exceed 170° F. there is very considerable suppression of scale formation, and even when the water temperature does rise above this figure the hard scale normally formed is generally replaced by a soft powdery deposit which can be removed easily from the walls of the appliance. This deposit is quite different from the hard rock-like material produced by similar water not treated with the active reagent. In addition the active reagent appears to cause the removal of hard water scale which may have been produced during prior use of the system.

In the following table are given some excerpts from the records of the district experience with these scale reducers; the results obtained are very striking.

TABLE I.

Type of Heater.	Hardness of Water (°Cl.) Total.	Hardness of Water (°Cl.) Temporary.	Duration of Test (months).	Remarks.
Single Point Storage	16–24	9.5–18	33–55	Tests on various hard water districts. No maintenance necessary on any heater. In some a very slight scale deposit, very thin and easily removed, had formed, while others were free from scale. Chalky sludge at the bottom of the storage container was present in most.
Multipoint Storage.	24	18	25	Slight scale on top surface of heat exchanger. Condition otherwise good. This heater has supplied 30,000 gallons hot water since installation. Trial continuing without cleaning.
Circulator	20	16	17	Comparison of two identical heaters, with and without scale reducer. There was a great difference in the amount of scale, the "dosed" heater showing up extremely favourably. "Undosed" heater almost completely choked.
Single Point Instantaneous.	50–60	10–12	21	Comparison of "dosed" and "undosed" heaters. Maximum scale in fin block more than five times as thick in latter as in former. Scale softer and less adherent in treated system.
Multipoint Instantaneous.	21	—	66	Slight nodular deposit at centre of fin block. Tubes very clean compared with other heaters on district. Scaling troubles normally prevalent at 120°F. water temperature with this type of heater. Sample on test was set at 150°F. for most of test period.

It will be possible to provide a hot water service, using gas, at least as simple to maintain as any alternative system.

Space Heating

In 1942 it became possible to give consideration to the problem of heating the small home. It is obviously desirable to have the heating appliances placed near the centre of the structure, and not against outer walls. The application of this conception introduced some architectural problems. At the time these were under consideration an opportunity occurred to discuss the matter with Mr. D. E. E. Gibson, the City Architect of Coventry. This led to a happy collaboration in the production of post-war houses already described in the technical Press. The aim was to ensure that without

exceeding the pre-war usage of fuel, a much higher standard of heating should be attained than had hitherto been offered to the "industrial family."

The effects of insulation of the building, of ventilation, and of the efficiency of the heating appliance on the heat required were given consideration. Subsequently certain government departments undertook similar work in the national interest and, as a result of the educational work done during the last few years by a few groups of interested people, there has been quite a revolution in the ideas held by architects and others concerned with house planning in this country as to the standard of comfort that should be provided. It is no longer thought to be satisfactory to have only one room habitable at a time. Young people setting up house in the future will call for a higher standard of comfort than that with which their parents and grandparents had to be satisfied. This improved standard is also required in the majority of existing middle-class houses, houses occupied by the quarterly consumer, and the Gas Industry, if it so desires, has a great opportunity to popularize the use of gaseous fuel for space heating by attention to such homes. Once the so-called upper middle classes have adopted gaseous heating, the others will follow.

In the past gas has been little used in the majority of homes for space heating. There are a number of possible reasons for this. Firstly, prejudice ; secondly, the attractiveness of the effects obtained with alternative fuels; thirdly, the cost of operation; and fourthly, the standard of comfort attainable in the periods for which the gas fires have been used.

It is now more than thirty years since W. R. Twigg proposed the shadowgraph test, and the hygienic standard that the gas fire should be designed so that all products of combustion shall be discharged from the flue outlet.

The position to-day is very different from that of the early part of the second decade of this century, when fires were made with ill-designed flue arrangements, so that, even when fitted at the foot of a chimney, an appreciable proportion of the products of combustion might be discharged into the room. It was probably owing to the escape of products of combustion, the fact that the combustion was incomplete, and the products were relatively rich in sulphur oxides, that the use of the bowl of water flourished, and it is not surprising the belief grew that gas fires were not really healthy.

Undoubtedly the early development of the gas fire was faulty, and the Industry has not yet lived down completely the reputation then earned. Much was done by men like H. H. Creasey and his colleagues in London in demonstrating to the medical profession and others the merits of the gas fire, but more such work is needed to give the public a real idea of the many advantages of the modern appliance. The representatives of gas undertakings who have contacts with consumers must know the gas fire thoroughly. They must appreciate the hygienic standards that are attained, the steps taken to ensure the combustion is complete, something of the stimulative effect of radiant heat, and the advantages which result from the use of gas fires supplying both radiant and convected heat. The staffs of undertakings may need educating to ensure that they can deal with such prejudices as still exist.

There are still many who find the open bituminous-coal fire most attractive. Considerations of convenience and cost of operation, especially for continuous use, however, are leading to the adoption of the closeable fire of the Siesta type, which emits much convected heat. This change of practice will lead inevitably to a change of public opinion as to what is desirable as a living-room fire, and young people now starting housekeeping give much thought to the elimination of unnecessary work and are not as "coal-fire minded" as their elders.

To be aesthetically satisfactory, the design of a fire must be characteristic of the fuel which is used, and essentially the gas fire should possess geometric uniformity.

The use of a fire designed to imitate the coal fire seems undesirable, especially to-day. It is realized that the alternative view receives strong support, and there is much to be said from the psychological point of view for a design such as that of the Cobble Fire, which resembled a coke fire. A radical change in gas fire design was effected some 14 years ago when there was introduced the luminous flame incandescent fire, which at the same time eliminated the columnar radiant. It seems probable that for a number of years to come a "neat" gas flame will be used in preference to the bunsen flame. Fires of this type can be made really silent and highly effective, whilst from the gas undertaking's point of view there is the special advantage of reliability in use in dusty places and of the need for very little maintenance.

(To be continued)

Installation of clockwork controllers for gas lamps in Dundee streets is to cost £24,120. There will be 7,144 controllers.

Mr. Emanuel Shinwell, Minister of Fuel and Power, states that a recent report in a London newspaper to the effect that a post to the value of £5,000 a year has been offered to at least five miners' leaders is totally untrue. Mr. Shinwell has, in fact, considered a number of names submitted to him by the National Union of Mineworkers for an appointment to the National Coal Board. He has issued an invitation to one person and to one person only, and is awaiting his reply.

Association of Gas Corporations

The annual general meeting of the Association of Gas Corporations was held at Gas Industry House on Feb. 13. Major Julian Day was elected Chairman of the Council, and Colonel R. H. Studholme Vice-Chairman.

Mr. H. A. Probin was appointed Hon. Secretary in the place of Mr. J. R. W. Alexander, who resigned on his appointment as General Manager of the British Gas Council.

The address of the Association in future will be: 1, Grosvenor Place, London, S.W.1. (Telephone No.—Sloane 4554. Telegraphic address—Segascor, Knights, London.)

Scientists and Modern Society

Professor A V. Hill, speaking on the responsibilities of scientists in modern society at a conference on science and the welfare of mankind, in London, urged scientists to refuse to co-operate in tasks in which they or their representatives were not allowed a reasonable share or partnership in the responsibility of deciding on the purpose, policy, or probable result of their work.

Professor D. Bernal, Vice-President of the Association of Scientific Workers, advocated free and rapid communication between all branches of science, with facilities for free transport and telephonic and radio communication between scientists.

Dr. Julian Huxley, Executive Secretary of Unesco, said that one of their first problems would be to secure the adhesion of the requisite number of nations, and the most important one was Russia. There would also have to be some sort of relation with the Atomic Commission and the Security Council of Uno. He hoped there would be strong representation of applied and industrial science on Unesco, which should stand strongly against any idea of scientific secrecy.

A Joint Trade Committee has been appointed by the Association of British Chambers of Commerce and the Federation of British Industries to formulate a joint national policy on overseas economic questions. While the aim is to put forward a common policy and to facilitate the task of the Government in securing the views of organized industry and commerce, each organization retains complete liberty of action to express to the Government and in other quarters its independent views on any subject coming within the purview of the Joint Committeee.

It is doubtful if, in all our history, we have been in such need of new standards of values and new lines of action in our social services as we are to-day. It was to ascertain to some extent the path we should tread that a conference on "The Needs and Problems of the Family" was held on Jan. 24 and 25 under the auspices of the British Social Hygiene Council and the Town and Country Planning Association. The conference was well attended, and a lively interest was shown in such points as education, health services, town planning, and housing and social welfare.

The Examination in "Salesmanship" conducted by the Incorporated Sales Managers' Association will be held on Mar. 30 in various centres throughout the country. Normally this examination is held annually, but I.S.M.A., appreciating the fact that large numbers of young men will be returning to civilian life during the coming months, has decided to hold a second examination in September or October with a view to assisting ex-Service personnel to obtain a qualification at the earliest opportunity. Full particulars regarding this, and the Examination in "Sales Management," may be obtained from the General Secretary, I.S.M.A., 23, Bedford Square, London, W.C. 1.

A New Scheme of training for local government service devised by the National Association of Government Officers will come into operation on April 1. In future all junior recruits who have passed the entrance examination must serve a six months' probationary period. Annual reports upon their personality and capabilities will decide their progress. To gain experience they may be transferred from one department to another and, in addition to compulsory part-time classes, they will have optional lectures and all facilities for study. Financial assistance may be given to a suitable candidate for a university degree or similar qualifications. A national scale of salaries has been arranged whereby increases are granted according to age, length of service, and efficiency.

Messrs. Baird & Tatlock, Ltd., have published a pamphlet describing the Mullard-B.T.L. Potentiometric Titration Apparatus, which was exhibited by them at the Physical Society's exhibition this year. An outstanding feature of this apparatus is the incorporation of an electron beam tuning indicator in place of a needle galvanometer. The mains-operated unit incorporates a stirring motor and most of its components are of new design. It may be used for the preparation of solutions of definite pH value and for measuring hydrogen ion concentration. The limit of accuracy is about 0.05 pH unit. In addition it is possible to determine the amounts of several metals in the presence of one another, and titrations involving oxidation or reduction reactions are easily carried out.

Further Distribution at Tottenham*

By ERIC O. ROSE, B.Sc., Assoc.M.Inst.C.E.

IN 1928 Col. H. C. Smith presented a Paper to the Institution of Gas Engineers, under the title of "Distribution at Tottenham." That Paper dealt with the reorganization of the Tottenham Company's distribution system which took place between 1925 and 1928. At that time the Company's area of supply comprised the areas of the original Tottenham and Enfield Companies, and covered 32 square miles. Since 1928 nine adjoining undertakings have been absorbed by amalgamation, and two further undertakings have passed into the Company's ownership. The aggregate area of supply is now 444 square miles. The purpose of this Paper is to describe the problems encountered and the developments carried out in the distribution of gas over this area.

In 1928 gas was manufactured at two stations, Willoughby Lane and Ponders End, and distributed through a system of trunk mains and district governors and at a maximum boosting pressure of 45 in. W.G. The greater part of the original supply area is now saturated with suburban development, and the trunk mains have been extended from time to time as occasion demanded. The basic principles laid down at the time of the earlier reorganization have, however, been adhered to. Amalgamation with the Southgate Company in 1938 added a contiguous suburban area and another manufacturing station. The Southgate Works was connected to the same medium pressure trunk mains system, and the three works now deliver gas into one common system at a maximum initial pressure of 24 in. W.G., boosting being controlled according to the manufacturing plant in operation at each of the works.

In 1939, to safeguard supplies against damage by enemy action, a number of auxiliary mains were laid, so that the whole system somewhat resembled a piece of wire mesh netting. Valves were fixed at all interconnexions, and the system was normally operated with all valves open. The result of this arrangement was that when damage was sustained at any point the section concerned was quickly isolated and the remainder of the system continued to operate with little loss in efficiency. Interconnexions linking this same trunk mains system with the Gas Light and Coke Company and the Hornsey and North Middlesex Companies were also made, and it is interesting to note that when, in January of last year, the storage capacity at Willoughby Lane Works was reduced from 12 million cu.ft. to 1½ million cu.ft. (against a daily output from this works of 16 million cu.ft.) it was possible, through the helpful co-operation of the Hornsey Company, for one of the Hornsey Company's holders to be used as a holder station attached to the Tottenham system. Gas was boosted into the Hornsey holder at night and returned into the trunk mains system during the day. This procedure has continued as a regular daily practice for some nine months.

Ponders End to Hertford

The trunk mains system between Ponders End and Hertford is shown in its present state in fig. 1. The first amalgamation to be made in this area was that with the Waltham and Cheshunt Undertaking, and this took place in 1929. The Waltham Works were to be closed down, and the two gasholders used for local storage from which local distribution would be made through the already existing system. The gas was to be manufactured at Ponders End, and it was necessary to lay an interconnecting supply main.

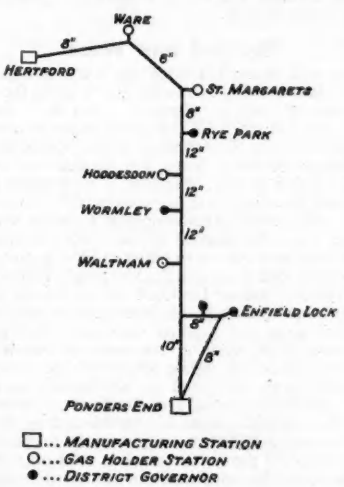

FIG. 1.

It may be useful here to set out in some detail the method adopted to determine the size of main and pressure to be adopted, as a similar procedure has been followed in all subsequent developments. The transmission system was designed to handle three times the existing demand for gas, and it was intended that the pumping plant should operate initially at or near full delivery rate for approximately 8 hours per day, the pumping hours being increased as the load increased.

The essential data required for the calculations were as follows:

Annual output at Waltham . .	125 million cu.ft.
Maximum daily output . . .	500,000 cu.ft.
Selected pumping rate . . .	75,000 cu.ft. per hour.
Number of pumping hours per annum:	
(*a*) at outset	1,667 hours.
(*b*) at full development . .	6,000 hours.
Length of main by selected route . .	3.27 miles.
Pressure required at termination of main	8 in. W.G.

The summarized calculations covering a range of pipe sizes from 6 in. to 15 in. diameter are given in Table I, together with the resulting costs per therm both initially and at full development.

As a result of these calculations a 10-in. diameter main was selected and duplicate steam engine driven Connersville compressors rated at 75,000 cu.ft. per hour to 4 lb. per sq.in. were installed.

The Lacey Formula

The main was laid, almost in a straight line, largely by wayleave over private grounds. Weldless steel pipes, bitumen coated and double hessian wrapped, were used and the joints were of the long sleeve lead wool type, though welded joints, either sleeve or butt jointed, have been used in all subsequent mains. Although no condensation in the main was anticipated, the pipes were laid to a minimum fall of 1 in 600 and syphons were inserted at suitable points. The whole of the route was accurately surveyed and levelled before main-laying was commenced, so that the syphons could be placed at points accessible by road or pathway to at least a hand-cart.

During the 16 years in which this section of main has been in operation the only syphon from which water has been pumped is that immediately following the compressing plant. The tendency with all other syphons is for the suction pipe to become blocked with dust.

The subject of laying a high-pressure main cannot be passed without reference to the formula used for the determination of the loss of pressure by friction. In this case, and in all subsequent cases, Mr. Stephen Lacey's version of the Unwin formula has been used. The formula is set out in Mr. Lacey's Paper read before the Institution of Gas Engineers in 1928. In the form in which it is given the formula is not capable of direct solution, and its use involves the expenditure of considerable time in "trial and error" calculations. To avoid this and facilitate rapid calculation a series of charts was prepared. The actual charts were drawn on log.-log. paper and covered a wide range, the various sheets being bound into a book. It is not possible to reproduce the charts in full here, but fig. 2 is a brief outline—without subdivisions—of one section of the charts.

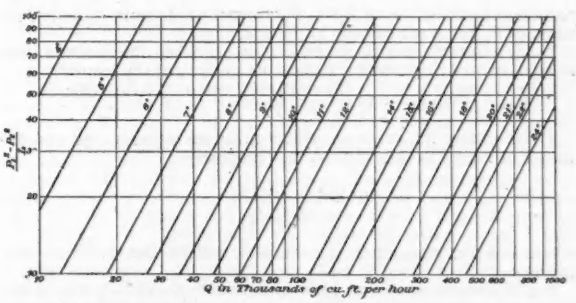

FIG. 2.—*Section of chart for high-pressure mains.*

* Paper to the London and Southern District Junior Gas Association, Feb. 8.

TABLE I.

	Diameter of main.				
	6 in.	8 in.	10 in.	12 in.	15 in.
Initial pressure, lb. per sq.in.	20.3	7.1	2.9	1.4	0.7
B.H.P.	92	41	19	10	6
Steam, lb. per hour	4,140	1,850	855	450	270
Cost of main per foot	7/-	8/6	11/-	13/4	16/-
	£	£	£	£	£
Total cost of main	6,042	7,388	9,496	11,507	13,812
Cost of wayleaves	700	700	700	700	700
Cost of main and wayleaves	£6,742	£8,088	£10,196	£12,207	£14,512
Cost of compressors	£1,500	£1,200	£1,050	£800	£600
Installation of compressors	200	200	200	200	200
Total compressor cost	£1,700	£1,400	£1,250	£1,000	£800
ANNUAL COST.					
	£	£	£	£	£
Interest on main and wayleaves 5%	337	404	510	610	726
Depreciation on main 2½%	151	185	237	288	345
Interest on compressors and installation 5%	85	70	63	50	40
Maintenance and depreciation on compressor 10%	150	120	105	80	60
Total fixed annual charges	723	779	915	1,028	1,171
Steam (initial load), 1,667 hr. at 1/- per 1,000 lb.	345	154	72	38	22
Total annual cost (initial load)	£1,068	£933	£987	£1,066	£1,193
Cost (initial load), pence per therm	0.410	0.358	0.379	0.409	0.458
	£	£	£	£	£
Steam (final load), 6,000 hr. at 1/- per 1,000 lb.	1,242	554	257	135	82
Total annual cost (final load)	1,965	1,333	1,172	1,163	1,275
Cost (final load), pence per therm	0.210	0.142	0.125	0.124	0.136

Lacey's formula is generally given in the form:

$$Q = 36.82\sqrt{\frac{P_1^2 - P_2^2}{P_a^2} \cdot \frac{D^5}{s\,L\,c}}$$

where Q = flow in cu.ft. per hour.
P_1 = initial pressure in lb. per sq.in. absolute.
P_2 = final " " " " "
P_a = atmospheric pressure in lb. per sq.in. absolute.
s = density of gas (Air = 1).
L = length of main in miles.
c = coefficient of friction determined from Reynolds criterion.
D = diameter of main in inches.

By fixing "P_a" at 14.7 and "s" at 0.5 the formula resolves itself into the form—

$$Q = 3.54\sqrt{\frac{P_1^2 - P_2^2}{L} \cdot \frac{D^5}{c}}$$

and a separate curve relating the function $\frac{P_1^2 - P_2^2}{L}$ to Q can be drawn for each diameter of pipe.

The use of the chart can be illustrated by the calculation of the initial pressure required in the case of the 10-in. main to Waltham already referred to. Given Q = 75,000, D = 10, L = 3.26 plus 5% for bends = 3.43 and P_2 = 8 in. W.G. or 15.0 lb./sq.in. absolute.

From the 10-in. diameter line on the chart the value of $\frac{P_1^2 - P_2^2}{L}$ corresponding to Q = 75,000 is found to be 24.

From this P_1 can be readily solved to a value of 17.55. This is equivalent to 2.85 lb. per sq.in. gauge.

The diagram has been particularly useful in calculating the pressure losses in long runs of main involving a number of sections each of different diameter and passing different quantities of gas. In such cases it is only necessary to find the value of $\frac{P_1^2 - P_2^2}{L}$ for each section and add values of $P_1^2 - P_2^2$ for the whole series together, the value of P_1 being solved only at the end.

Lacey's formula can be simplified for use when the pressure drop is small by assuring that P_1, P_2, and Pa are practically identical. $\frac{P_1^2 - P_2^2}{Pa^2}$ then becomes $\frac{(P_1 - P_2)(P_1 + P_2)}{Pa^2}$ or $\frac{2(P_1 - P_2)}{P_a}$.

Transforming the pressure units into inches water gauge and the length of main into feet the formula becomes—

$$= 189\sqrt{\frac{D^5 H}{c\,s\,l}}$$

where H is the pressure drop in in. W.G. and l is the length of main in feet.

Fig. 3 shows curves that have been drawn to relate pressure loss inches of water gauge per 1,000 ft. of main with rate of flow for each diameter of pipe.

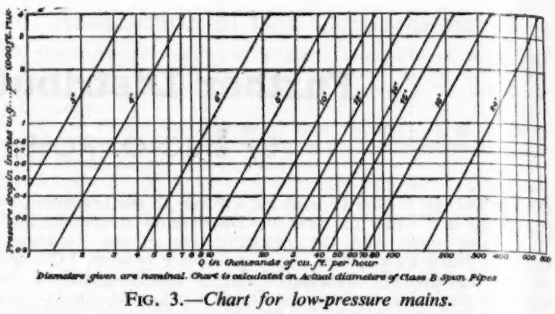
Pressure drop in inches w.g. per 1000 ft. run
Q in Thousands of cu. ft. per hour
Diameters given are nominal. Chart is calculated on Actual diameters of Class B Spun Pipes

FIG. 3.—*Chart for low-pressure mains.*

This formula has been found to be remarkably accurate. It should be noted that Pole's formula is unreliable when applied to small pipe diameters, and that both Pole's formula and the Chicago formula give false results at low velocities.

To return to the development of the Ponders End–Hertford system, the amalgamation with the Hoddesdon Undertaking in 1932 brought about the extension of the Waltham main to Hoddesdon. The main was to supply the existing holders at Hoddesdon and serve two district governors, one at Wormley and the other at Rye Park. This latter was at the extreme end of the main and beyond the Hoddesdon holder station. The location can be seen by reference to fig. 1.

When gas was being delivered into the Waltham holders only the operation of the Waltham station had been entirely automatic, the inlet main to each holder being automatically closed by a stop valve as it reached full inflation. The introduction of Hoddesdon, however, brought a new problem. If two widely separated holders are connected to one line with their inlets controlled only by limiting stop valves, the second holder will only receive gas when the first holder is fully inflated and its inlet valve closed. A district governor situated at the end of the line beyond both holders would only receive gas when both holders were full. As it was not considered economic to staff each holder station with three shifts of valvemen, suitable automatic gear had to be devised.

The maximum flow of gas to be passed through the district governor at Rye Park was first determined, and the remainder of the available 75,000 cu.ft. per hour was divided between the two holder stations in proportion to the requirements of the districts they served. The rates of gas flow through each section of the main being thus established, the pressures required at the two stations to maintain this flow were then calculated. These pressures were maintained by fitting a relief valve to the inlet of each holder station. These valves remained closed until a predetermined inlet pressure was reached so that no gas could be taken into the holders if the pressure in the trunk main fell below the set figure. Sufficient pressure was thus maintained in the trunk main to ensure that the Rye Park governor was always supplied, and that one holder station did not rob the other. The back-pressure valve at Hoddesdon was installed to provide gas for the Rye Park governor at holder pressure when pumping at Ponders End was stopped each night.

The relief valves were adapted from Peebles Governors operated backwards and weight loaded to the required relieving pressure.

The limiting stop valves fitted to the holders were of the Donkin type. The operation of these in conjunction with a column girded holder is simple enough, but the arrangements required for a spiral holder are not quite so easy.

Hertford and Ware

The Hertford and Ware Undertakings were amalgamated at the same time as Hoddesdon and it was decided to close the Ware Works, concentrating manufacture at Hertford. An 8-in. interconnecting main was laid, and Connersville compressors were installed at Hertford. Later, in 1939, the St. Margaret's Gas Company was acquired and the connexion between Ware and Hoddesdon completed via St. Margaret's. There is now, therefore, a continuous main between Ponders End and Hertford with a manufacturing station and compressing plant at each end. The completed layout is shown in fig. 1.

It has not yet been the practice to work both compressing plants on to an open main and one valve between Hoddesdon and Hertford is always kept closed, the Ware and St. Margaret's loads being switched on to either Ponders End or Hertford as conditions demand.

The filling of the holders at all intermediate stations is entirely automatic, relief valves and limiting stop valves being employed as already described. For control purposes a two-wire telephone circuit runs throughout the whole length of the system. Widlake holder stock indicators are fitted to all holders, and the booster attendants at both Ponders End and Hertford can read the stock at any station. The required station can be selected by the operation of a dial, similar to that installed on an automatic telephone, and when the station is connected the holder stock is read on a milli-ammeter. The system also provides telephone communication between all the stations over the same wires. The selective apparatus was made by the Standard Telephone Company and was not costly.

In the initial stages the private telephone circuits were rented from the General Post Office, but later it was decided that private pilot

cables should be laid with the mains. The first of these pilot cables was laid on the 2-mile stretch between Hertford and Ware. Armoured lead-covered paper-insulated cable was used and the total cost was £184. The annual rental from the G.P.O. would have been £16. This cable was installed in 1931, and there has been absolutely no maintenance on it since that date. The use of private cables also avoids the trouble arising from interference. G.P.O. lines, being laid with other circuits in multi-core cables, are often subject to interference when men are working on the lines.

There are two interesting features in the laying of the trunk mains already described, and both concern the transport of pipes. The 12-in. diameter main between Waltham and Hoddesdon was largely laid alongside the railway line where road access was impossible. Altogether about 4 miles of main had to be laid in this way. The railway in question was a main line and traffic was fairly heavy, but it was found that, with the exception of one newspaper train, the down line was clear for about 5 hours between midnight on Saturday and 5 a.m. on Sunday. A special train was therefore chartered each Saturday night, and this was made up of 6 bolster wagons each carrying 12 lengths of pipe in random lengths of approximately 50-ft. each. Approximately 1,200 yards of pipe was thus carried on each train. Each wagon was manned with a squad of men, and at the starting-point one pipe was rolled off each wagon simultaneously. The train then moved on for approximately its own length and the process was repeated. In six stops therefore the whole of the pipes were laid out ready for laying. As the pipes had sleeve welded joints it was essential that all trains arrived with the sockets pointing in the same direction. Instructions to this effect were given to the Railway Company, and the number of reversals in the complete journey from the Midlands was carefully worked out by them. There were a few slips on account of trains being sent by different routes, but on the whole the scheme was successful.

The 8-in. main between Hertford and Ware was laid, for the greater part of its length, along the towpath of the Lee Navigation. As this was also inaccessible to road traffic it was arranged that the pipes should be loaded on to barges in the Midlands. They were then brought to site via the Grand Junction Canal, the Regents Canal, and the Lee Navigation. The whole consignment arrived together in five barges, and a ten-shilling tip was sufficient to induce the Admiral of the Fleet to bring his craft in-shore and move them from point to point so that the whole length of main could be laid out. For this modest sum the services of his wife and many children were also obtained to assist in the unloading.

South Bedfordshire System

The purchase of the Hitchin and Stevenage Undertakings in 1933 and the Biggleswade and Shefford Undertakings in 1934, with their subsequent amalgamation, led to the centralization of manufacture for this area at Hitchin.

Stevenage, the only undertaking lying to the south of Hitchin, and some five miles distant, was connected first. A 6-in. diameter main operating at 4 lb. per sq. in. was laid, and two villages, Great and Little Wymondley, previously unsupplied, were given supply *en route*. A small low-pressure system, fed through a Peebles mercurial governor, was laid down in each village.

Biggleswade, lying 11 miles to the north of Hitchin, already had its own high-pressure system, and gave supply to Arlesey and Henlow through 3-in. and 4-in. diameter mains working at a pressure of 15 lb. per sq.in. Some 110 consumers were given service direct from the H.P. mains through governors of the early Jeavons type. The high-pressure mains extended southwards from Biggleswade towards Hitchin and it was decided to link these mains to a new compressing plant at that Works, thus forming a high-pressure system to supply the whole region.

A map of the district, with the existing and new mains, is shown in fig. 4.

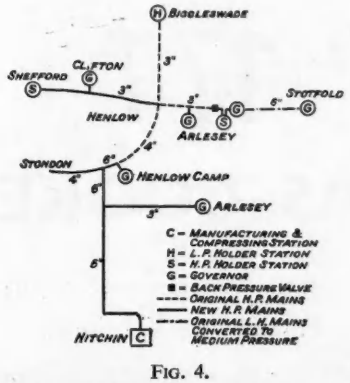

FIG. 4.

A scheme was prepared in which allowance was made as usual for a 200% increase in load, together with allowances for Shefford (then still independent), the R.A.F. aerodrome at Henlow (the load from which it was hoped to secure) and other neighbouring undertakings.

The pressures to be employed were largely determined by the sizes of the existing mains, and the final scheme provided for a 6-in. diameter main from Hitchin to link with the existing mains at Henlow.

Assessment of the loads existing and anticipated showed that the initial peak demand from the system would be 16,500 cu.ft. per hour while the possible maximum might reach 60,000 cu.ft. per hour. The capacity chosen for the compressors at Hitchin was 30,000 cu.ft. per hour, and an initial pressure of 20 lb. per sq.in. in the main was necessary. To lower the dew point of the gas it was to be compressed to 30 lb. per sq. in., and throttled through a reducing valve to 20 lb.

Testing of New Mains

Had it been thought advisable to provide for the larger output of 60,000 cu.ft. per hour at the outset an initial main pressure of 60 lb. would have been necessary, and the compressors would have had to work to 100 lb. per sq.in. to obtain a sufficient reduction in dew point. Such provision was not made, but to guard against any future increase in pressures it was decided that all new mains laid should be tested to 100 lb. per sq.in. and all governors and service equipment suitable for operation at 75 lb. per sq.in.

The compressors installed were single-stage vertical steam-driven sets and were supplied by Messrs. Peter Brotherhood. They were controlled to maintain a pressure of 30 lb. per sq.in. in a receiver from which delivery to the main was made. The gas stored in the receiver and mains was sufficient to meet the night demands so that the compressors could be closed down between the hours of 10 p.m. and 6 a.m.

Delivery into the holders at Biggleswade and Arlesey was made through simple cocks 1½ in. and 1 in. in bore respectively. These were operated by limit gear on the holders. Each cock was covered by a check cock which was set to prevent delivery in excess of capacity of the main. The maximum deliveries allowed were 10,000 cu.ft. per hour and 5,000 cu.ft. per hour for Biggleswade and Arlesey respectively.

The main holder at Biggleswade was of the spiral type, and it was necessary to design special gear for operating the limiting stop cock. Provision had to be made for the possibility of the holder over-running the stop point on account of a temperature rise. Such over-running is possible without damage to the valve gear.

All new consumers taking supply from the main were provided with Jeavons governors having maximum capacities of 200 cu.ft. per hour or 350 cu.ft. per hour, according to need, and all the existing governors were taken out and overhauled.

When Shefford was added to the system, it was found that the gasholder was worthless and the whole town was supplied through a Reynolds governor. This type of governor was chosen so that an even low pressure could be maintained on the existing low-pressure mains. This was thought advisable as the "unaccounted for" at Shefford had been somewhat high.

In laying the main to Shefford, supply was also given to the village of Clifton, partly direct from the high-pressure mains which passed through the main street, and partly from a new low-pressure system laid to serve the side streets. This low-pressure system was supplied through a 2-in. Jeavons governor. This type of governor is considerably simpler and cheaper than the Reynolds governor, its only disadvantage being that it gives a distinct rise in outlet pressure of some 2 in. w.g. when "locking-up" at no load. As the low-pressure mains to be served at Clifton were all new, this was not considered to be a serious disadvantage.

Mains Above Road Level

The 3-in. diameter main laid to Shefford, and other mains laid subsequently, were not laid to "falls" and no syphons were provided. The saving in cost resulting from this was surprising. The abandonment of "falls" and syphons made it possible to lay mains in the verges of country roads at only 18-in. cover, no provision being made in the levels for any future road widening. The mains were, in many places, well above the level of the road. In places where road widening has taken place later it has been found that there is no difficulty in lowering a length of main without breaking joint. This practice has done much to lessen the otherwise high capital cost of rural distribution.

With the onset of the war the development of industry in the Bedfordshire area brought heavy increases in gas demands. The maximum hourly delivery rate of the Hitchin compressors was soon exceeded, and it was necessary to make provision to meet a higher hourly demand from the high-pressure system during the daytime hours. It would have been possible to have done this either by doubling the capacity of the compressors and increasing the initial distribution pressure to 60 lb. per sq.in. or by doubling the compressors, duplicating the mains, and retaining the original distribution pressure. The former would have entailed the installation of an entirely new compressing plant, which could not have been obtained in less than 12 months and would have involved a heavy expenditure of power. The latter would have meant the laying of many miles of new main, and was to be avoided if at all possible on account of labour shortages. To avoid both these alternatives it was decided that the best method of increasing the capacity of the system was by the further development of local storage.

The first step taken was to build an additional gasholder at Biggles-

. . . We are pleased to be able to tell you that the new Main Gas Cookers have already reached production—although in quantities that are, as yet, not unlimited.

Their features include modern design with no projections from the sides; quick boiling burners of higher efficiency; spring-loaded taps to prevent accidental turning; numbered Mainstat control; oven door which covers the entire width of the cooker, and is provided with a stop; door hinges and all pipework concealed . . . Then, of course, there is that high standard of vitreous enamel finish for which we are famous.

MAIN

R. & A. MAIN LIMITED
LONDON AND FALKIRK

No. **177**

GAS COOKER

In Grey Dapple and White Vitreous Enamel finish

wade. This increased the storage to a capacity equal to the daily demand from the low-pressure system at Biggleswade. It was then possible to close the holder inlet valves from approximately 8 a.m. to 5 p.m. each day, the holders being filled only at night. A greater quantity of gas was thereby made available during the daytime to consumers coupled directly to the high-pressure system.

The villages of Arlesey and Stotfold had previously been supplied at low pressure from a small gasholder at Arlesey which had a capacity of only 7,000 cu.ft. As the demand from these two villages grew this holder became practically useless and was replaced by two high-pressure holders, the first of 10,000 cu.ft. and the second of 40,000 cu.ft. capacity. These holders are both of the cylindrical type and are of welded construction. They are designed for a maximum working pressure of 40 lb. per sq.in. and are filled direct from the high-pressure mains, the compressors at Hitchin being operated to their maximum pressure of approximately 36 lb. per sq.in. The two holders are fed from the high-pressure mains through a back-pressure valve and the gas passes out through a governor to serve the village of Stotfold. There is no local compressing plant, and the station requires no attendance or maintenance except the daily changing of pressure charts and the usual periodical cleaning of the governor. The capacity of the station has been designed to be sufficient to carry the whole of the load from Stotfold from 8 a.m. until 3 p.m. The whole system is pumped up to 36 lb. per sq.in. during the night, and however great the demand from the high-pressure mains during the morning and to whatever extent the pressure in the mains may fall there will always be sufficient gas in the holder station to ensure supply to Stotfold.

The village of Arlesey, which extends over a length of nearly 2 miles, is still supplied from the high-pressure mains by two governors, though it is intended to install a high-pressure holder when the load demands it. High-pressure storage, operating on a system similar to that at Arlesey, but consisting of five second-hand balloon barrage hydrogen containers, has recently been installed at Shefford. The present position on the high-pressure system is therefore that all the larger low-pressure systems served by it have their own local storage of sufficient capacity to carry them from early morning until past the mid-day peak. The full capacity of the compressors at Hitchin is thus reserved for the supply of the many consumers connected directly to the high-pressure mains.

Automatic Booster Stations

When the Waltham Company was amalgamated it was found that exceedingly low pressures were experienced in the Sewardstone Road area. Here there were some 4 miles of main, partly 4 in. and partly 6 in., supplying 163 consumers, many of whom were situated at the extreme end.

Careful pressure records were taken, and from these it was calculated that the maximum demand from the main was 4,000 cu.ft. per hour.

Although relatively few consumers were affected the matter had to be dealt with, and the relay of 4 miles of main was out of the question on the score of cost.

Comparative estimates for local storage both at low and high pressures were made, but although the cost involved in the construction of a low-pressure holder would have been reasonable, this cost would have been completely overshadowed by the cost of obtaining Parliamentary sanction. An alternative scheme for an automatic booster was therefore adopted.

The boosting plant is situated on a small plot of land at the commencement of the 4-mile length of main, and consists of a two-stage fan with a capacity of 8,000 cu.ft. per hour against a differential pressure of 20 in. W.G. It is driven by a 1 h.p. electric motor and operated by a clock mechanism. The clock employed is identical and interchangeable with the clocks fitted to public lamps.

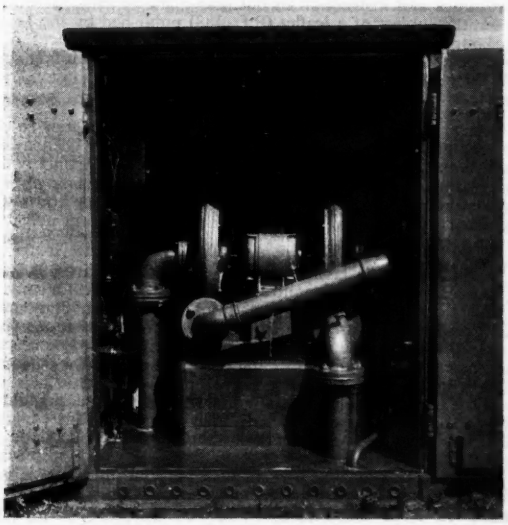

FIG. 5.

No building is provided, but the whole apparatus is enclosed within a cast-iron kiosk. A non-return valve, by-passing the booster, is contained in an outside pit. A photograph of the installation is given in fig. 5.

The operating hours are as follows :

7 a.m. to 9 a.m., 11 a.m. to 2 p.m., and sunset to 8 p.m., and the clock is wound and set by a public lamp controller in the course of his normal round.

All services beyond the governors were fitted with service governors, and after exhaustive tests the Horstmann governor was fitted throughout.

The cost of the installation was as follows:

	£	s.	d.
Plant and installation	308	11	9
Land and fencing	154	15	0
	£463	6	9

This plant was installed in 1931, and has worked with perfect satisfaction ever since.

A few years later a similar plant, serving some 300 consumers and designed to pass 12,500 cu.ft. per hour against 25 in. W.G. differential pressure, was installed for the Goffs Oak section of the Waltham area. In 1940 a miniature plant of the same type was put up to serve Roydon. This had a capacity of only 2,000 cu.ft. per hour against 5 in. W.G. In this case no additional land was purchased, the kiosk being situated in the verge of the highway. The total cost was only £170.

Local High-Pressure Storage

In another instance the problem of giving increased supply to outlying villages was solved by the adoption of automatic high-pressure storage. Two straggling villages were served by a 2½ mile length of 4-in. main, and there was a drop of 195 ft. in altitude from one end to the other. 6-in. W.G. initial pressure gave only 4.5 in. at the far end during the night hours, and at mid-day Works outlet pressures had to be raised to 10 in. or more to maintain the statutory minimum. The introduction of a war factory further increased demands, and action had to be taken.

Examination of pressure records showed that a pressure of 4.5 in. was available at the end of the main between the hours of 9 p.m. and 6 a.m., and it was calculated that if gas were drawn off into storage at the rate of 500 cu.ft. per hour the pressure would drop to 4.0 in. W.G. In this way a total of 4,500 cu.ft. could be put into storage each night.

As the station was to be on a miniature scale it was necessary for all equipment to be as simple as possible and entirely automatic in operation.

The plant provided consisted of:

(*a*) An electrically driven compressor rated at 500 cu.ft. per hour at 50 lb. per sq.in. This was obtained by purchasing a standard compressed air unit as sold to the motor trade for tyre-pumping, &c. The outfit was fitted with a switch which automatically cut out the motor when a pressure of 45 lb. was reached and cut in again at 35 lb. This switch was wired in series with a time switch set for operation between 9 p.m. and 6 a.m. The combined effect was that the compressor would start at 9 p.m., provided the pressure was below 35 lb., and would stop either when a pressure of 45 lb. was reached or at 6 a.m., whichever was the sooner. The only alteration required to the standard compressor was the addition of gas-tight glands to the crankshaft bearings.

(*b*) Storage tanks to hold 6,000 cu.ft. at 45 lb. per sq.in.

(*c*) A Reynolds duplex governor connecting the storage tanks to the low-pressure mains. This governor was set to 3.5 in. W.G. outlet pressure and the type of governor selected ensured a steady line at all loads. The effect of this governor was to supply gas into the low-pressure main whenever the pressure tended to fall below 3.5 in. W.G. As the operation of the compressor at night only pulled the pressure down to 4.0 in. W.G. it was impossible for station to short-circuit itself by both giving out and taking in gas at the same time.

A diagram of the plant is given in fig. 6. The station is filled with a two-pen pressure recorder giving high and low-pressure readings on a weekly chart. Since the original installation further storage has been added, the pumping hours extended and the governor set down to 3.0 in. W.G.

The compressor and governor are contained in a small brick house, ventilated by louvres in the gables. The compressor is air-cooled and the building is not heated in the winter. It was found necessary, however, during frosty weather, to fix a small electric car heater under the governor to prevent freezing up. The cost of the whole installation was £520.

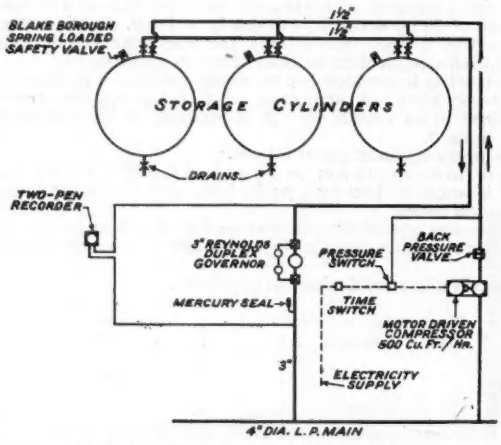

FIG. 6.—*High-pressure storage station.*

Mains Department Organization

It can be understood that the steady and continued growth of the Tottenham distribution system has called for intensification of the Mains Department, and it may be appropriate to give here some particulars of the organization.

Originally the development of the system was undertaken, alongside all other new construction work, by the Company's engineering staff acting through the central drawing office, the work of laying trunk mains being undertaken by contractors. There was also a mains department, acting under the Distribution Superintendent, that carried out the laying of low-pressure mains, up to 12 in. in diameter, by direct labour gangs. Pressure records over the district were taken by the public lighting department, and boosting was controlled by the engineers in charge of the various works.

It became apparent, as time went on, that more co-ordinated control was required, and in 1938 a new mains department was formed. This new department has its own drawing office, and its members form part of the engineering staff at the Chief Offices. The diversion between "Engineering" and "Distribution" takes place, therefore, at the point where the service leaves the main, and not where the mains leave the gas-works as in most other undertakings. It was felt that the development and control of an extensive system of distribution was essentially an engineering matter and should be dealt with accordingly. The Mains Engineer now controls the whole system and carries out all extension work, whether undertaken by direct labour or contractors. Boosting is controlled by the various works engineers in consultation with the Mains Engineer, and in the case of the Southern Area, where three manufacturing stations deliver into a common system, the boosting at Ponders End and Southgate are directed from Tottenham. The day-to-day programme of gas manufacture is also directed from Tottenham, and the Widlake distant pressure recorders terminate in the booster house there.

In the Southern and Hertford areas (Hitchin and Dunstable excluded) there are altogether 26 district governors and 409 district valves, and in 1939, with the approach of war, a new system of control was brought into action. The central item of this control was a key operating map, locked copies of which were kept in the A.R.P. control room, the Mains Engineer's office, the Assistant Engineer's office, and the various booster houses concerned. Every valve is represented on this map by a coloured pin, four conditions being shown by different colours, thus:

Red . .	Valve closed.
Green . .	Valve open.
Yellow .	Valve slightly open (to maintain gas pressure in dead section of main).
Blue . .	Valve subject to daily operation by works boostermen.

Each valve has a number, and each group of valves in any locality has a group reference number.

The group reference numbers refer to a series of detailed plans, in each of which the exact locations of the various valves are given. These plans are bound into a book, and a copy has been issued to the Mains Superintendent responsible for outside work, his Assistant, and all men whose duty it might be to operate valves in emergencies. The book also contains a tabular statement giving precisely all the information that might be required by anyone carrying out a valve operation.

This system fully justified itself during the periods of enemy action. Any decision to open or close valves was made by the Mains Engineer or another responsible official in the Control Centre, and it was only necessary to telephone the number of the valve to be operated to the man selected for the duty. He was in possession of the full information, and could ensure that he went to the site with the proper valve keys, found the right valve, turned it in the right direction and gave it sufficient turns to close it fully. All valve movements were communicated to the works booster houses, and a responsible officer unlocked the copy of the map there and corrected the pins accordingly.

For the maintenance and repair of district governors and valves a mobile workshop has been instituted. This consists of a large covered van manned by a fitter-driver and a mate. Sufficient tools, including welding equipment, are carried to undertake all emergencies. The outfit has proved exceedingly useful, and its crew have been able to undertake many miscellaneous but essential duties connected with the department, for example:

Routine inspection and cleaning of governors.
Routine inspection of valves.
Setting and maintenance of pressure recorders.
Operation of special tools such as pipe-cutting machine, petrol driven pumps, &c. (Special tools are taken out by the van for a special job only, and are brought back and cleaned by the crew before being put into store.)
Maintenance of pneumatic tools.
Setting of Elkington manhole covers.

It has been found, in fact, that there is no end to the duties that can be carried out by a properly equipped fitter in preference to being left to the type of man usually recruited into a mains gang.

In addition to the mobile workshop the Department is equipped with a mobile crane, two mobile compressors, two trailer compressors, pneumatic tools, pneumatic pumps, pneumatic pipe-cutting machine, power rammers, petrol-driven "Homelite" pumps for trench work and "Ransome Rapier" pumps for cleaning syphons and flooded mains.

Now that the war is over plans have been prepared and have, in part, already been commenced, for further extension and reorganization of the Tottenham distribution system, but it would be premature for this future work to be described on this occasion. Investigations are also being made into the further use of mechanical plant in main-laying work. There is no doubt that the shortage of unskilled labour will justify the more extensive use of trenching machines, cranes and other labour-saving plant.

(*Discussion will be given in a later issue*)

Murex dual purpose screens and helmets for arc welding are described in a new leaflet (M.37) issued by Murex Welding Processes, Ltd., Waltham Cross. New features, adding to the facility with which the welder can operate, are embodied in these screens and helmets, which are shock-resisting and comparatively non-hygroscopic.

We acknowledge with thanks the receipt from Messrs. Paul Elek (Publishers), Ltd., 36–38, Hatton Garden, E.C. 1, of the second volume of the *Materials Handling Manual*, edited by M. M. and G. W. Williamson. The price of this book, which contains a series of articles accompanied by 418 diagrams, is 30s.

A relaxation of the restrictions governing the printing of advertisement posters is announced by the Ministry of Supply. Former restrictions are cancelled by the Control of Paper (No. 72) (Economy) Order, 1946, which came into force on Jan. 29. Items affected include show cards, display cards, and window bills. Unfortunately, only a very limited quantity of paper will be available for posters.

Many Young Men and Women have, by their war service, lost opportunities and instruction in business management. Their problems are the subject of a leaflet (P.L. 188) published by the Ministry of Labour and National Service. The leaflet announces a new scheme designed to compensate them for their lost training, and to enable their service experience to be used to advantage in industry and commerce.

A Recommendation that a minimum standard of efficiency be established for all heating and combustion appliances has been made to the Government by the Scottish Fuel Efficiency and Economy Committee. It is also suggested that, before a new housing project is embarked upon, competent heating engineers should be consulted to ensure that the provision of heating facilities will be in accordance with the scientific and technical knowledge available.

A British Standard Classification of Wood Preservatives, B.S. 1282, has just been issued. A committee of the Institution has for some time had under consideration the preparation of a British Standard for Wood Preservatives based on laboratory performance tests. It has not been found possible at the present juncture to devise acceptable tests to assess penetrating power and permanence, and the preparation of such a specification has been abandoned for the time being. In view of the post-war building programme, a largely increasing demand is likely to arise for wood preservatives by users with little experience of their suitability, properties and methods of application. The Classification, which defines the main types of wood preservatives and includes notes dealing with their application and use, is issued as an interim measure for the guidance of such users. Copies may be obtained from the British Standards Institution, 28, Victoria Street, London S.W. 1, price 2s.

Gas Undertakings' Results

Altrincham Gas Company.—The profit shown by the revenue account for 1945 is £23,170, and the balance on profit and loss account available for dividend is £10,122, which provides for final payment in respect of the full statutory dividends, less tax, and leaves £6,933 to be carried forward. Gas sales amounting to 570,706,581 therms and yielding £140,771 reached a record in the history of the Company in 1945. The Company celebrates its centenary this year.

Blyth Gas Company.—Revenue in 1945 amounted to £76,030 and expenditure to £65,931, leaving a profit of £10,099. Income from gas sales totalled £56,968, compared with £51,313 in the previous year. A final dividend of 4%, making 7% for the year, leaves a balance of £14,738 to be carried forward.

Cardiff Gas Light & Coke Company.—Further advances in costs of coal, material and labour during 1945 necessitated a further increase in the price of gas under special permit from the Ministry of Fuel and Power. Net revenue carried to profit and loss account was £63,155 compared with £65,796 for the previous year, and a final dividend of 3½% on the Consolidated Ordinary Stock makes 6% for the year, the same as for 1944. Gas sales, including public lighting, yielded £501,301, the sales to private consumers amounting to 10,419,506 therms. Coal carbonized amounted to 166,124 tons, and sales of residual products included 55,639 tons of coke and 1,560,518 gall. of tar. Manufacturing costs were £604,526 and distribution £63,264.

Croydon Gas Company.—The Directors recommend dividends in respect of the half-year ended Dec. 31 at the following rates per annum, less tax: Preference Stock 4%, Maximum Dividend Stock 5%, Sliding Scale Stock 6%. In spite of the difficulties of the past year the supply of gas has been fully maintained. Gas sales at 17,302,481 therms show an increase of 8% over 1944, yielding £852,360, against £755,819. The balance carried to net revenue account was £204,308 compared with £135,812. Payment of dividends at the same rates as for the previous year leaves £84,207 to be carried forward, against £81,292 brought in.

Gas Light and Coke Company.—The report and accounts confirm the preliminary announcement of an Ordinary dividend of 5%, the same as for 1944. Gas sales in 1945 at 238,911,276 therms showed an increase of a little over 2% over the previous year. Coal carbonized amounted to 2,622,676 tons, against 2,569,151 tons, and the quantity of oil gasified was 26,884,068 gall. compared with 25,032,117 gall. Sales of gas brought in £12,252,458 (£11,666,726), including £146,125 (£55,282) from public lighting. By-products yielded £4,481,479 (£4,301,889). Manufacturing costs again increased to £11,167,753 (£9,890,122), and the balance carried to net revenue was £3,388,220 (£3,863,596). Net revenue after costs and rates was £3,836,699 (£4,352,253), and included gross dividends and interest received, £202,790 (£205,385), and reduction in rates charged in periods prior to 1945, £200,000 (£236,239). Profit after providing for taxation was £1,187,859 (£942,525).

Hartlepool Gas and Water Company.—Gas sales in 1945 amounted to 799,447,500 cu.ft., compared with 777,895,700 in 1944, and yielded £123,497 against £117,028. Profit for the year after paying debenture interest and providing for taxation was £15,169. A final dividend of 2½% makes 4½% for the year, and leaves a balance of £22,223, compared with £23,524 brought in.

Ipswich Gas Light Company.—There was an increase of over 44 million cu.ft. in gas sales in 1945, equal to 4.16% in 1944. Balance carried to profit and loss account was £15,119. Dividends have been declared for the December half-year at 5½% on the Consolidated stock, and 5% on the 5% Preference stock, leaving a carry-forward of £11,958. Presiding at the 125th annual meeting on Feb. 14, Mr. Henry Woodall, referring to the proposed nationalization of the Gas Industry, said they had nothing before them to consider at present, and could only assume that nationalization meant the compulsory purchase by the State of their property on terms which they might have little opportunity of discussing and criticizing. It seemed to have been assumed by the public that nationalization would automatically result in economies. There was no justification for such an assumption, but if, as the Directors believed, it was wrong, its error could unfortunately only be proved after much damage had been done and the remedy made correspondingly difficult. The Directors did not think it would be wise to take any direct political action, but considered that, provided it was clearly understood that the Industry did not approve of nationalization from any point of view, they could best serve their interests by supporting the British Gas Council in its policy of keeping in close touch with the Ministry of Fuel and Power. Pending further developments they would continue to maintain their undertaking in the highest possible state of efficiency.

Newcastle-upon-Tyne and Gateshead Gas Company.—A new high level of gas sales was reached in 1945, when 52,948,204 therms were sold for £1,528,492. The balance carried to net revenue account was £222,334. A final dividend of £2 17s. 6d.% on the Ordinary stock makes £5 7s. 6d.% for the year, and leaves £119,402 to be carried forward, compared with £99,060 brought in. With the approval of the Ministry of Fuel and Power the acquisition of the Alnwick Gas Company has been effected by means of an exchange of stocks. Reference is made in the Directors' report to the Report of the Heyworth Committee. "They are," they say, "in close touch with the situation, and in the event of nationalization being imposed upon the Industry they will use every endeavour to secure equitable terms for the proprietors, the officials, and the employees."

Oxford and District Gas Company.—Gas sales in 1945 totalled 7,904,722 therms, a decrease of 1.3% on 1944, when a total increase of 46% over the 1939 figures was recorded, last year's decrease being due mainly to a reduction in the industrial load. Income from gas sales was £307,796, against £283,892, and manufacturing costs were £404,684, against £366,510. Balance to profit and loss account was £43,084 (£34,027), and a final dividend of 5% on Consolidated Ordinary stock makes 10% for the year. In his statement issued with the accounts, the Chairman, Mr. H. M. Lodge, said the Company had undertaken the first part of an extensive programme to provide supplies of gas to new housing estates and to improve the supply generally throughout the area. Development of the distribution system had been held up during the war years, and the total length of mains now exceeded 300 miles. The impending prospect of nationalization must not hold back their progress, and the Directors had felt obliged to continue the policy of integration which they had pursued for some years past. They had recently reached an agreement for the purchase of the Wantage U.D.C. gas undertaking, and preliminary steps were being taken to obtain a Provisional Order authorizing the amalgamation. At the same time the Company intended to apply for permission to raise further capital for this purchase and for other purposes.

Portsmouth and Gosport Gas Company.—The balance carried to profit and loss account for 1945 was £93,859, compared with £95,250 for the previous year. Gas sales and rentals at £908,579 showed an increase of £128,163, and represented the sale of 16,571,347 therms, an increase of 10% on 1944. Manufacturing costs went up from £720,256 to £840,147, and coal carbonized totalled 166,369 tons, against 157,266 tons in 1944. The dividend on the Consolidated stock is 7¼%, the same as for the previous year.

Reading Gas Company.—The Directors report that sales of gas and residual products during the year ended Dec. 31 were very satisfactory. The balance carried to profit and loss account was £37,742. Gas sales totalled £317,542, against which manufacturing costs totalled £416,146 and distribution £50,669. Interim dividends at statutory rates for the six months to June, 1945, were paid in September, and dividends at similar rates for the half year to Dec. 31 are to be paid on Mar. 1, less tax. Arrangements were made for the redemption of £45,390, 4% Redeemable Debenture Stock, 1945/55, to take effect on Jan. 1. In its place the Directors have issued £45,000 3½% Redeemable Debenture Stock, 1966/71, and most of the holders of the 4% Stock have agreed to convert their holdings into the 3½% Stock.

Sheffield and District Gas Company.—During 1945 the quantity of gas sold for industrial and domestic purposes was 12,330,764,600 cu.ft., a decrease of 957,720,400 cu.ft. In addition, bulk supplies of 870,781,000 cu.ft. were sold to neighbouring undertakings, making a net decrease of 945,839,400 cu.ft., or 7.1% compared with 1944, the total output being 13,201,545,600 cu.ft., against 14,147,385,000 cu.ft. The Company bought coke oven gas to the value of £465,212, against £432,587 in the previous year, and the income from gas sales was £1,467,037, a decrease of £19,936. The balance carried to profit and loss account was £418,953, against £352,723. Dividend is maintained at 6½%, and £125,768 is carried forward.

South Suburban Gas Company.—Sales of gas in 1945 increased by 7½% in comparison with 1944 and were about 1% less than in 1938. The Directors report that there is a very large demand for gas-fitting work and appliances which cannot be met due to the shortage of gasfitters who are still in the Forces, and the very limited number of appliances available. The calorific value of the gas supplied by the Company was reduced from 530 to 515 B.Th.U. on Nov. 1, 1945, except in those areas formerly supplied by the Sevenoaks and Tonbridge Companies. Net revenue for the year was £293,944. The income from the sale of gas amounted to £1,592,704 against £1,423,044 for the previous year. The dividend for the half year ended Dec. 31 on the Ordinary Stock is 2½%, making 5% for the year and leaving £51,670 to be carried forward.

Spalding Gas Department.—The abstract of accounts for the year to Mar. 31, 1945, shows a gross profit of £10,281, the highest in the history of the undertaking and attributable to expanding income, practically all sources showing a substantial increase. Income from prepayment consumers has been increasing during recent years at a more or less uniform rate, but a notable feature of the accounts under review is the recovery of income from ordinary consumers, the figure for 1944-45 of £14,710 exceeding all previous records. Income from both residual products (£11,428) and sale of fittings (£2,136) show substantial increases. Net profit amounted to £870 and was carried to the appropriation account, the credit balance on this account being £1,827.